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Trend exploration of MEDIAS acoustic surveys for early warning and prioritization of small pelagics assessments in the Mediterranean

Giacomo Chato Osio & Finlay Scott

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Contact information

Name: Giacomo Chato Osio

E-mail: giacomo-chato.osio@jrc.ec.europa

JRC Science Hub

<https://ec.europa.eu/jrc>

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Abstract

- The objective of the report is to detect steep declining trends in biomass and abundance, of anchovy and sardine from acoustic surveys in the Mediterranean Sea. Declining trends would give an early warning on the recent stock dynamics and potentially trigger a EC DG MARE request of priority stocks for assessment.
- Overall the attempt of identifying trends was severely limited by lack of submissions and data quality issues. This was the first such attempt and it nevertheless highlights potential needs of focusing attention on stocks of Sardine in SA 6, Anchovy and to less extent Sardine in SA 17 and 18. Potentially other stocks could need attention but it was not identifiable with current data.

1 Introduction

- The DG MARE DCF data call for the Mediterranean and Black Sea of April 2015 contains a specific deadline in March 2016 requesting only MEDIAS data for Summer 2015. The rationale behind this third deadline was to get the earliest possible information on the performance of the small pelagics stocks in the Mediterranean. The objective is to detect steep declining trends in biomass and abundance, or in particular age classes. Declining trends would give an early warning on the recent stock dynamics and potentially trigger a MARE request of priority stocks for assessment or, if linked to some management decision rule (which is not the case), trigger management action.
- The Call deadline for submission was 10 March 2016. The only Member States that submitted acoustic files complying with the call were Italy, Spain, Slovenia (included in the Italian submission for SA 17). Croatia sent a file but it did not contain 2015 data as requested. France and Greece failed to meet the deadline.
- Greece provided unofficially the full time series, including 2015 data (only for SA 20). France also attempted to provide the data but the abund_biom table, sent unofficially, is incomplete.
- Complete and official time-series that included 2015 are therefore only from Italy, Spain and Slovenia. These, along with the previous submission from other MS, were used for the current analysis by using the table "abund_biomass" which contains the estimated abundance and biomass at age for Sardine (PIL) and Anchovy (ANE) derived from scientific acoustic surveys. The choice of using the age data rather than the length was to avoid having to perform the conversion from length to age with growth parameters that are not known.
- Two visual identification of trends were performed:
- At an aggregated level across age classes, trends in biomass and abundance were explored.
- At a disaggregated level, trends in biomass and abundance were explored by cohort.

2 Trends in overall biomass and abundance

- For both species, numbers and biomass by sex were combined across all age classes to detect overall temporal trend. By plotting the data (Figure 2-1) it is immediately apparent that there are problems with the scales of some yearly estimates in abundance:
- In Spain (ES) in SA 1 and SA 6 it is evident that in 2012 and 2013 the numbers at age have been provided in actual numbers rather than thousands as specified in the Data Call, while the rest of the data are in thousands.
- In Italy for PIL and ANE, in SA 16, data pre-2012 appears to not be reported in thousands, while the data since 2012 is in thousands.
- In Malta, SA 15, the scaling of PIL is strange in the first years of survey, but it is not clear what is the source of the strange pattern.
- In SA 22 there is an anomaly associated with the estimates in 2012, for details see next section.

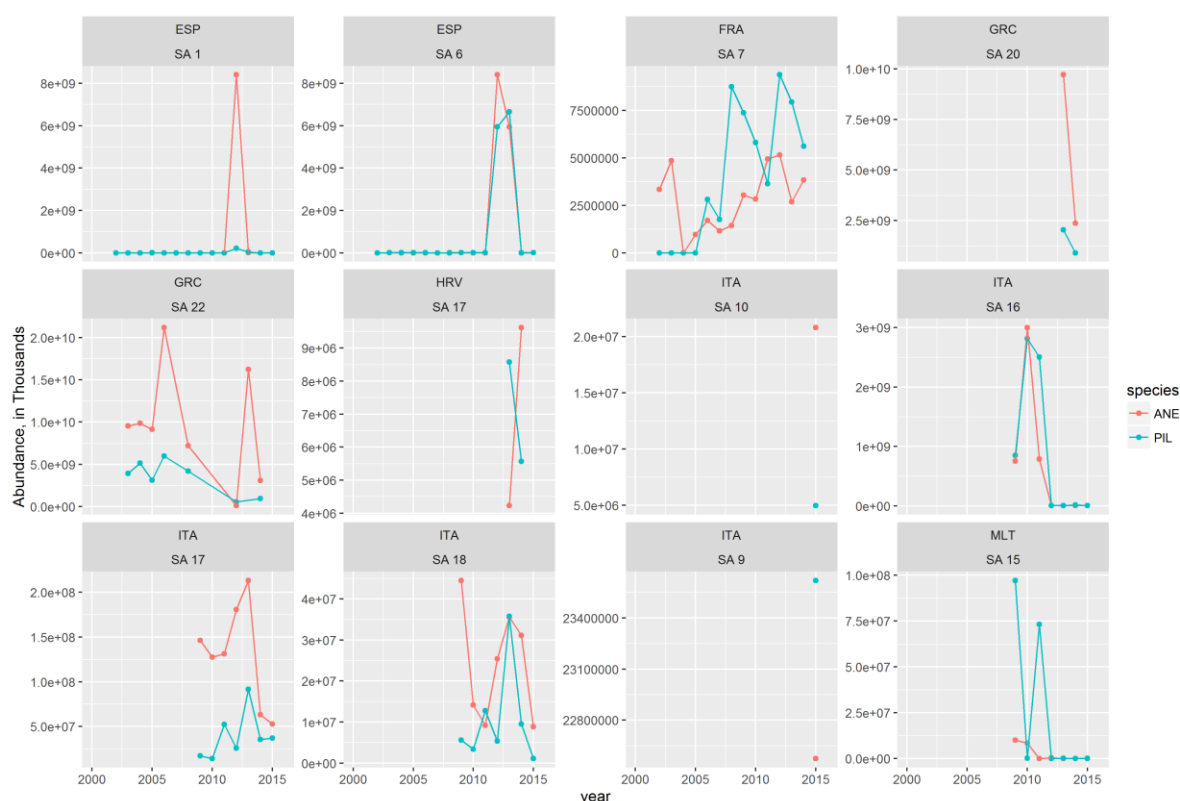


Figure 2-1 UNCORRECTED trends in Abundance (Number of Fish in Thousands) for Sardine (PIL) and Anchovy (ANE) by Country and Area from acoustic survey.

- The Biomass at age, which is requested in Metric Tons, should be less subject to misreporting of the units since it is requested in Tons actual numbers and not in Thousands as Abundance.
- The Biomass plot (Figure 2-2) shows more realistic trends in areas SA 6 and 16 but PIL in SA 1 shows a peak in 2005 that is very high, 3x the biomass of 2005. In SA 15 the trend for both species presents a similar pattern as identified for Abundance and it remains unclear why biomass declined so much in recent years.



Figure 2-2 UNCORRECTED trends in Biomass (Tons) for Sardine (PIL) and Anchovy (ANE) by Country and Area from acoustic survey.

- To try to analyse the Abundance in SA 1, 6 and 16, an attempt of rescaling the numbers of fish across all age classes was made, where the problem of scaling was obvious. The data corrections are the following:
 - In SA 1 for ANE and PIL, 2012 abundance data was divided by 1000
 - In SA 6 for ANE and PIL, 2012 and 2013 abundance data was divided by 1000
 - In SA 16 for ANE and PIL, pre 2012 abundance data was divided by 1000
 - In SA 15 no rescaling was attempted
 - In SA 22 no rescaling was attempted
- Based on the rescaled data, an attempt of exploring the officially submitted data is made. This exercise should be taken with great caution as the rescaling was applied the same way across age classes. If the original reporting of units was inconsistently wrong for individual age classes, the rescaling attempt will not improve the data.
- Corrected trends in Abundance are plotted in Figure 2-3.
- The trends that can be reliably identified in the most recent years are the following:
 - SA 1, for ANE and PIL, trends in biomass appear increasing in recent years (Figure 2-2), for abundance rescaling the data does not seem to fix the apparent problems (Figure 2-3), and thus should not be considered. These series were rescaled.
 - SA 6, the trend in abundance and biomass for PIL is increasing since the beginning of the series and the rescaling of abundance seems coherent with biomass. Concerning ANE the trend in biomass and abundance is coherent (after

rescaling abundance) and 2014 was a recent low point but 2015 estimates are going upwards. These series were rescaled.

- SA 7, for PIL the initial estimates of biomass and abundance seem very low compared to the rest of the time-series, after 2005 the trends are upwards except in 2013-2014 where they go down. For ANE the recent year trends are increasing.
- SA 9-10 report only one year of survey data and no trend can be explored. MEDIAS survey was performed in these areas for the first time in 2015.
- SA 16 for abundance and biomass, PIL has been increasing in abundance in recent years except the last one where a steep drop appears in 2015. ANE seems stable over the available years. These series were rescaled.
- SA 17 HRV, it is not possible to derive a trend with only two data points.
- SA 17 and 18 ITA for ANE and PIL the last 3 years show declining trends in abundance and biomass, with some of the recent points in biomass being the lowest of the available time series.
- SA 20 and 22, see details in next section, data from 2012 presents some problems.

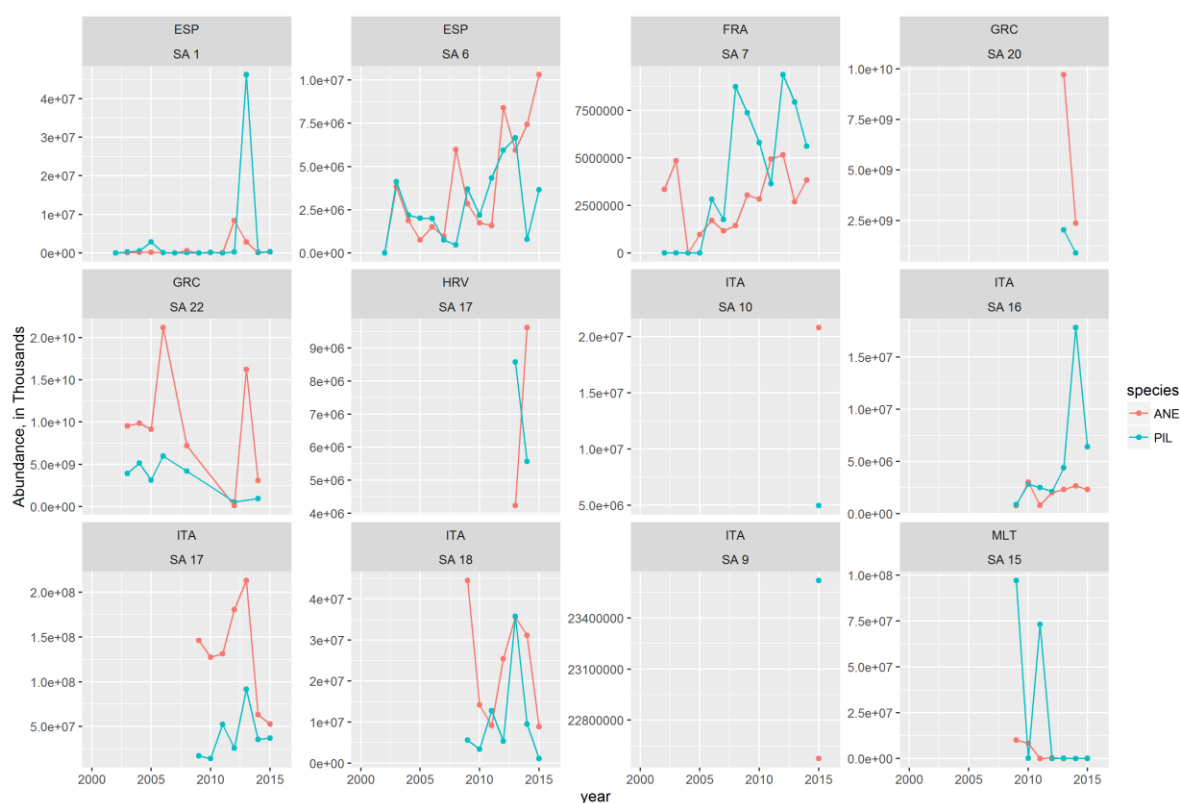


Figure 2-3 RESCALED trends in Abundance (Thousands) for Sardine (PIL) and Anchovy (ANE) by Country and Area from acoustic survey.

3 Trends in Abundance and Biomass At Age

Trends in abundance and biomass at age are summarized in Figure 3-1, Figure 3-2 and Figure 3-3. The data rescaling is the same applied above.

Results:

- SA 1, despite the rescaling of abundance numbers, the trends of ANE and PIL still present odd scaling and are thus not considered. These series were rescaled.
- SA 6, ANE decreasing trend in abundance for age 0 and increasing for age 1 and 2, similar pattern for biomass. These series were rescaled.
- SA 6 PIL, the rescaling of abundance looks reasonable and in line with biomass. Age 0 abundance steeply dropped after 2013 but in 2015 started increasing again. Age 1, and to a lesser degree Age 3, abundance and biomass on the other hand seem declining since the beginning of the time series. These series were rescaled.
- SA 7 ANE, data ends in 2014, for abundance and biomass Age 0 is the lowest age class and the trend is flat, Age 1 and 2 fluctuate with respectively a peak in 2012 and 2011 with subsequent declines.
- SA 7 PIL, data ends in 2014, for abundance and biomass Age 0 is the most abundant, with an extreme increase between 2007 and 2008 and a steep decline in the last 3 years.
- SA 9-10, only one year of acoustic data does not allow a trend exploration.
- SA 15 for PIL and ANE the drop in abundance in recent years seems related to a scaling problem but no attempt of correction was made, so trends could not be inspected.
- SA 16 ANE, abundance of Age 0 is increasing in recent years, Age 1 is at its lowest point in 2015 and Age 1 is declining in recent years. Biomass is similar. These series were rescaled.
- SA 16 PIL abundance and biomass of Age 0, 1 had the highest points in 2014 but dropped steeply in 2015. No Age 2 and 3 is reported for 2015. These series were rescaled.
- SA 17 HRV, no evaluation of trends is possible with only data from 2013 and 2014. 2015 data was not submitted.
- SA 17 ITA, the trends in abundance of Age 0 and 1 ANE is steeply declining with the last year being the lowest of the time series. Similar trend in abundance of Age 2. Biomass of ANE shows similar patterns.
- SA 17 ITA PIL, there was a drop in abundance of Age 0 and 1 from 2013-2014 followed by a small increase in 2015. Age 2 abundance is increasing in the last years. Age 0 biomass is the lowest of the series in 2015 and Age 1 is declining in the last years, while Age 2 is increasing in the most recent years.
- SA 18 ANE, abundance and biomass of Age 0,1,2 steeply declined from 2014-2015. Age 1 biomass is at the lowest point of the series.
- SA 18 PIL, abundance and biomass of Age 0,1,2 steeply declined from 2013-2015 and are at the lowest of the time series.
- SA 20 ANE and PIL, only two years of data are available officially, for Age 0 2014 abundance and biomass are much lower than 2013.
- SA 22, ANE, based on official data ending in 2014, data are available 2003-2007, no data 2008-2011, then data for 2012 and 2014. Abundance and biomass in 2012 seem extremely low compared to 2014 and there could be a scaling problem in 2012 or the fact that the survey was performed in December while is

usually performed in the summer. By plotting the unofficially submitted data containing also 2015 data in SA 20, there is a substantial change in the overall patterns in Abundance (Figure 3-3), with a change in the overall trend between the period before the 2008-2011 break and the period after. Given the difference between the two data sets it is difficult to trust any of the two since they give opposite trends.

- SA 22 PIL, presents a similar situation as for ANE (Figure 3-3), with a substantial difference between the officially submitted data and the unofficial one. Also in this case it is not possible to comment on trends not knowing which data is correct.
- SA 20 and 22 PIL and ANE, the absolute numbers in abundance are the highest of all areas which seems questionable and it hints that there might be some problem with the units of these surveys.

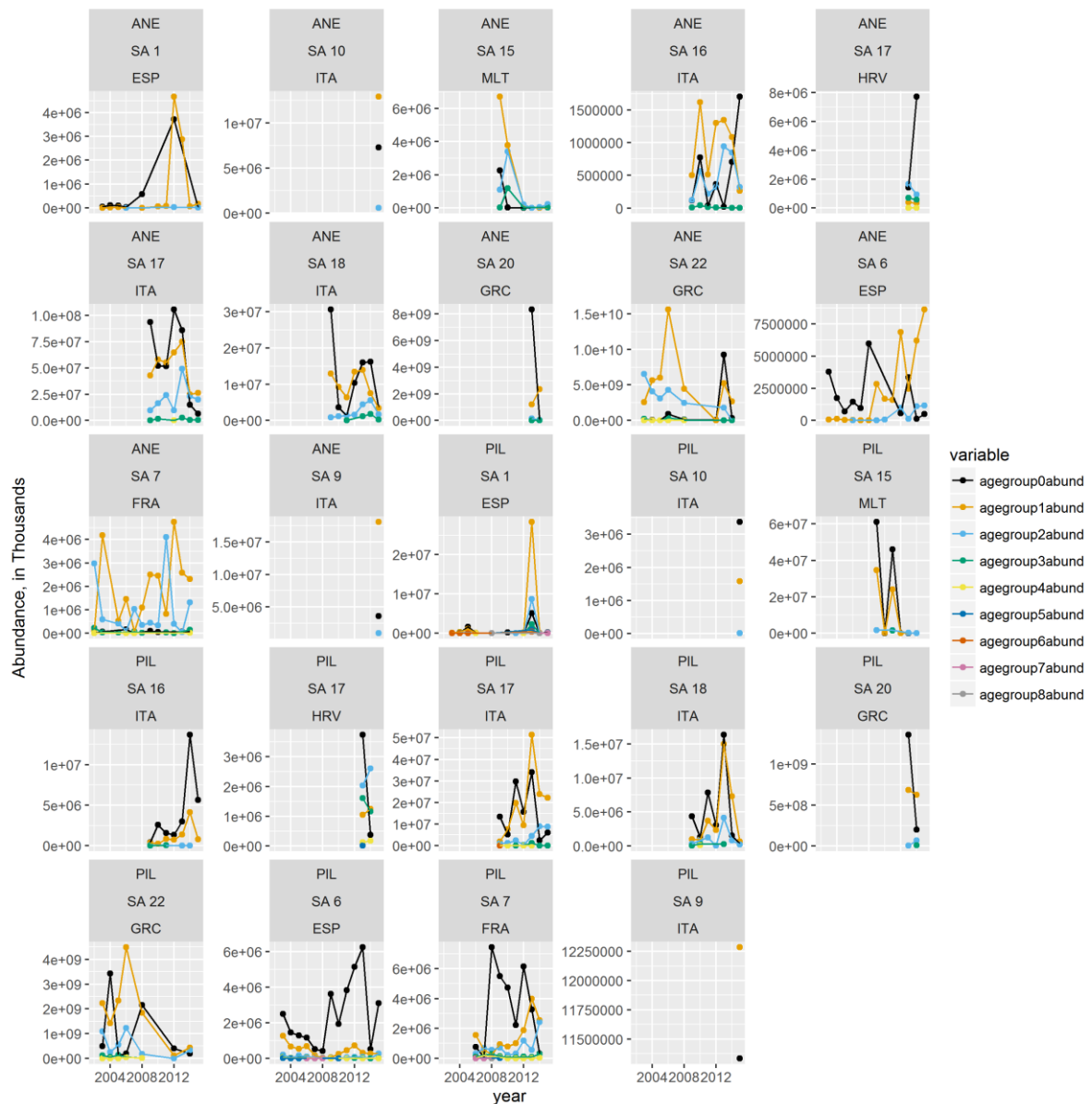


Figure 3-1 RESCALED Abundance trends (Thousands) for Sardine (PIL) and Anchovy (ANE) by Country and Area from acoustic survey.



Figure 3-2 UNCORRECTED trends in Biomass (Tons) for Sardine (PIL) and Anchovy (ANE) by Country and Area from acoustic survey.

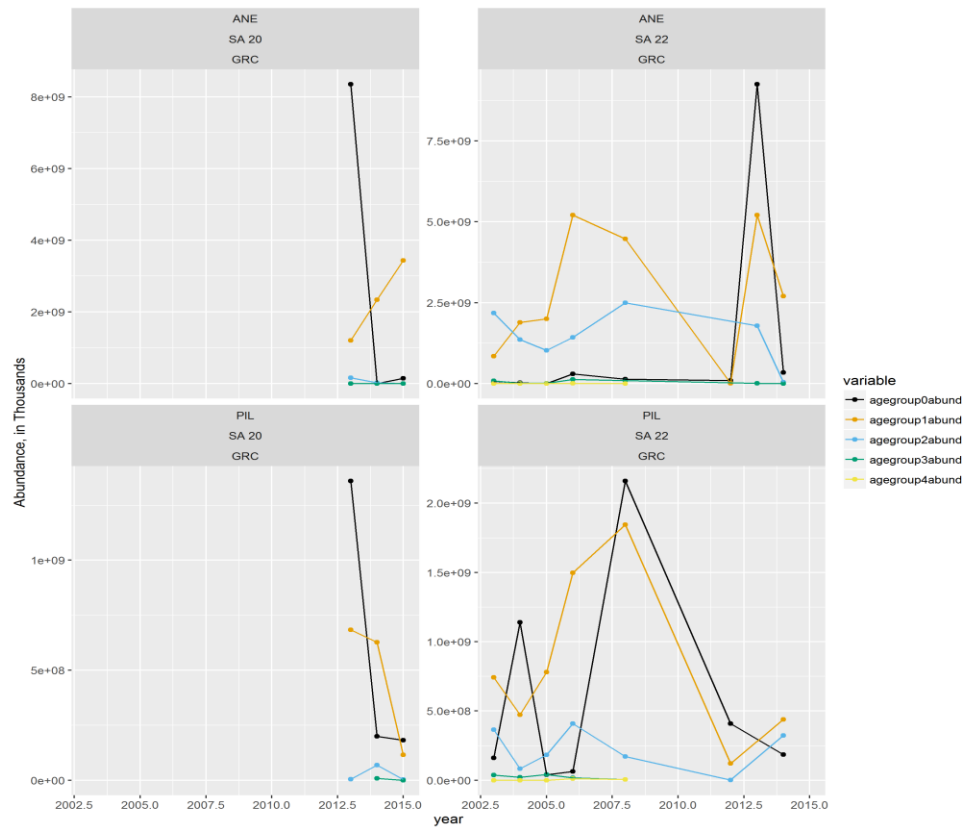


Figure 3-3 UNOFFICIAL Abundance trends (Thousands) for Sardine (PIL) and Anchovy (ANE) from GREECE by Area from acoustic survey.

4 Conclusion

- Based on the previous sections we combine the exploration on cohorts and aggregated ages to draw the following conclusions.
- Lack of transmission of data from a number of MS (Greece, France, Croatia) prevents any trend exploration attempting to use the most recent 2015 summer survey data from these countries.
- There are major problems in the units of the abundance at age data transmitted from many Member States to JRC (Spain SA 1 and 6, Malta SA 15, Italy SA 16, Greece SA 22). This could be in part due to transforming numbers at age to thousands for some years but not in others and/or to problems in converting from a comma to point for decimal separator in Excel files. Some of these units errors had been identified before (like the case in SA 6), discussed with experts in charge of the data but with no follow up in the most recent data call.
- Concerning the objective of the report, e.g. the qualitative identification of trends:
- No conclusions about trends can be drawn based on different types of data problems outlined above for SA 1, SA 15, SA 22, SA 20.
- In SA 6, data were rescaled so identification of trends should be taken carefully. For ANE there is a decreasing trend in abundance and biomass for age 0 and increasing for age 1 and 2. For PIL, Age 1, and to a lesser degree Age 3, abundance and biomass seem declining since the beginning of the time series.
- In SA 7 trends could be explored only up to 2014, so it is not relevant for this exercise, but both these stocks have been difficult to assess with full analytical methods and further attempts should be made.
- In SA 9-10 only one year of data was available, no trend could be identified.
- In SA 16, due to rescaling, the trends should be taken with extra caution, but overall there might be declining trends for ANE Age 1 and 2. For PIL 2015 was a quickly declining year hinting, with the lack of Age 2 and 3 that there should be closer investigations.
- In SA 17 and 18 ITA, there are quickly declining trends in abundance and biomass for both Sardine and Anchovy, these are identified reliably.
- Overall the attempt of identifying trends was severely limited by lack of submissions and data quality issues. This was the first such attempt and it nevertheless highlights potential needs of focusing attention on stocks of Sardine in SA 6, Anchovy and to less extent Sardine in SA 17 and 18. Potentially other stocks could need attention but it was not identifiable with current data.
- The trend exploration performed here was qualitative, this approach has clear limitation. More statistical based approaches could be implemented to better detect trends or account for example of the changing timing of the surveys. As an example, Greece performed the most recent surveys in the months of September (2015), in October (2014) in December (2012) while over the period 2003-2007 in June-July. An overview of the timing of acoustic surveys is plotted in Figure 4-1.

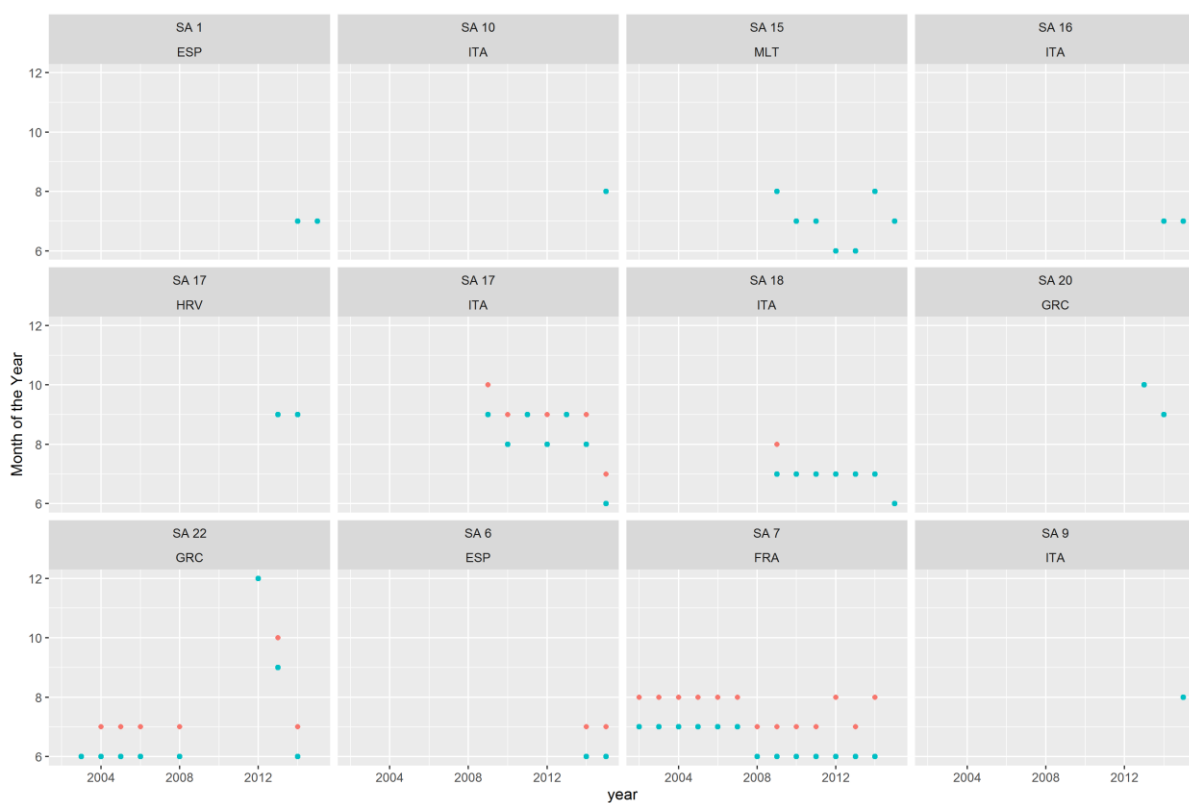


Figure 4-1 Timing of acoustic surveys by GSA and Country, in blue Start Month, in red End Month (when only one point there is overlapping), in many areas timing of the survey is not reported.

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